

User Manual of FTC91 Series

AU3TECH RESEARCH PTY LTD

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Instructions

Overview

This document mainly describes the appearance, application scenarios, installation, debugging, operation, maintenance, etc of Laser Focus Tracking Controller 91 Series (FTC91 Series).

Please read the manual carefully before using the controller and relevant devices, which help you operate it better.

Since the product functions are constantly updated, the products you receive may be a little different from the descriptions in the manual, for which we are deeply sorry.

Reader Objects

This manual mainly is applicable to the following personnel:

- Installation engineers
- Maintenance engineers
- Operators

Symbol Descriptions

As for the symbols in the document, their meanings are as follows:

Symbol	**Descriptions**
 **Forbidding**	It indicates there is high potential hazard. If it cannot be avoided, the equipment is seriously demanded, even personnel gets hurt.
	It indicates there is medium or low potential hazard. If it cannot be avoided, personnel may get hurt slightly or moderately.

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Warning	
 **Care**	It indicates potential hazard. If the texts are ignored, the equipment may demanded; data may lose; the performance of equipment may reduce; or other unpredictable results.
 **Tips**	It indicates that it can help you solve a certain problems or save your time.
 **Illustration**	It indicates that it is the overhead information of the text and it is the emphasis and supplement of the text.

Modification Records

Modification records accumulate the descriptions of the updating of the document. The latest version includes the updating contents of previous versions.

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1 Overview

1.1 Product Overview

FTC6105X FTC91 Series is a fiber focus tracking controller. It adopts the principles of capacitive sensing to make real-time tracking and adjusting the distance between the laser cutting head and processing parts so as to maintain cutting point always at the best position of laser focus. It greatly increases the surface smoothness of the processed things, improves processing speed and reduces the raw material loss in the processing.

Fiure1-1 Product Appearance



Product Features:

Intelligent Control

■ One-button automatic calibration, accurately calibrate capacitance within the ranges of 0.1mmto 10mm.

■Perfectly support different kinds of capacitive sensing nozzle and support plate, fine, 3D and other cutting application

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■Support leapfrog cutting and support online setting of sensitivity, stop height, operating speed, punch height and other parameters.

■Support the automatic identification of panel loss/crash and other abnormal cases and support communications with many upper computers

Stability and Reliability

■Equipped with servo motor, greater tracking speed and less response time than that of servo motor

■Compatible with PA8000, Weihong and other mainstream numerical control software and support online upgrading

■Technical anti-interference design; support the micro tracking (up to 0.2 mm) with plates; more stable effect and higher accuracy of repeated positioning

Friendly Interface

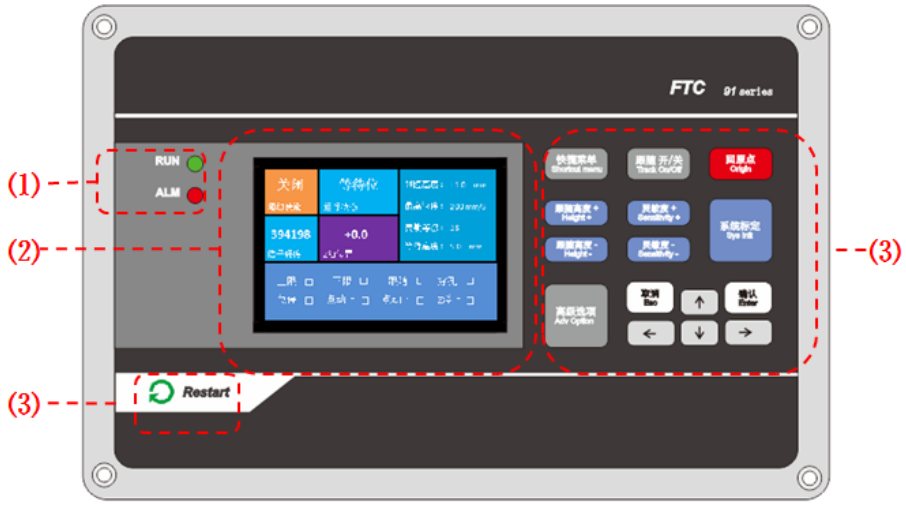
■Man-machine interaction of 3.5 inch IPS color screen+ multi buttons and provide more friendly operation experience

■Real-time multi state display, multi I/O state display and real-time display of Z-axis; it is convenient for users to check the operation of system

■Intelligent system allows users self-define shortcut menu

1.2 Descriptions of Product Panel & Port

Figure 1-2 Sketch Map of th panel of FTC91 Series



(1)state indicators (2)LCD (3)Button

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Table1-1 Descriptions of Indicator Light of FTC

Silk-print	Color	States	Descriptions
RUN	Green	0.5Hz Blink（1SON，1SOFF）	Operation is normal
		Normal OFF	System is abnormal
ALM	Red	Normal OFF	Operation is normal
		2 Hz Blink（0.25SON，0.25SOFF）	System gives out an alarm.
Notes: when system gives out an alarm during tracking, FTC is at a state of protection, please remove the failure according to indications and reset it.			

Table 1-2 Button Descriptions

Button	Functions
System calibration	1. Servo calibration: calibrate and compensate null shift of servo mtore, and usually used in the first power-on 2. Floating head calibration: measure the corrspondence of the capacitance and location between floating head and panel. Regural calibration ensurestracking effect.
Shortcut menu	Enter the shortcut menu of system (the interface can set the common self-defined parameters)
Advanced options	Enter theparameter interface of system (the interface can set all parameters)
Tracking on/off	Simulate the on-off state of tracking signal of numerical control system; used for manual operation
Return orgine	system stops all operation, returns to orgin and waits for next order
Tracking height+	Increase the tracking height between floating head and panel and can be adjusted by real-time means
Tracking height-	Decrease the tracking height between floating head and panel and can be adjusted by real-time means
Sensitivity+	Increase the tracking sensitivity of floating head and can be adjusted by real-time means
Sensitivity-	Decrease the tracking sensitivity of floating head and can be adjusted by real-time means
Enter	Enter current operation
Cancel	Cancel current operation
Direction keys(up, down, left and right)	1. Change cursor position of display screen 2. Change parameter 3. Adjust the position of floating head manually at waiting state

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Restart	Restart the system

Figure1-3 Sketch Map of Connection Ports of FTC91 SERIES

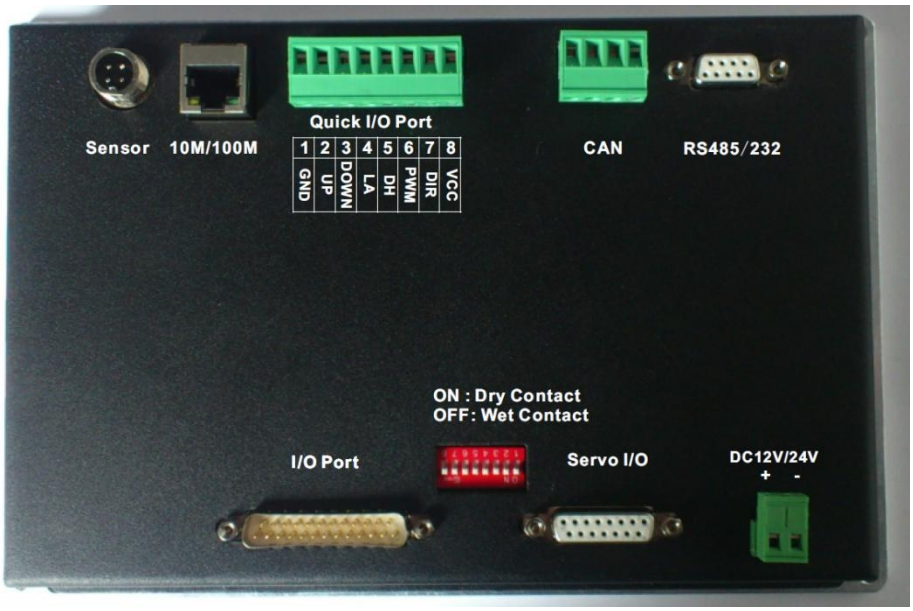


Table1-3 Definitions of Ports

Name	Functions
DC12V/24	Supply DC input voltage within the ranges of 12V/24 V（±10%）
Servo I/O	Port of servo driver
I/O Port	Input/ output port: including ports of No.8 on-off input, No. 6 on-off output, NO.1 analog quantity output and No.2 analog quantity input
Sensor	Port of preamplifier
10/100M	Internet access
Quick I/O Port	Quick I/O Port includes “upper limit/UP”, “lower limit /DOWN”, “tracking /LA”, “punch /DH”, “PWM”, “DIR”, is used for quick connection or debugging
CAN	Bus interface of CAN
RS485/232	General serial port
Dial switch	Set I/O active or passive

Notes

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- Please never switch on any signal in the undefined base pin or for other use.



Descriptions

- For detailed connection diagram, please refer to Chapter Three Installation & Connection

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2 Function Introductions

2.1 Descriptions of Interface &Parameters

2.1.1 Hierarchy Chart of Operation Interface Switch

Figure 2-1 Hierarchy Chart of Operation Interface Switch

主界面 Main interface	系统标定 System calibration	标定界面 Calibration interface	机械参数 Mechanical parameter
	高级选项 Advanced option	高级选项界面 Advanced option interface	运行参数 Operational parameter
	快捷菜单 Shortcut menu	快捷菜单界面 Shortcut menu interface	工艺参数 Technological parameter
			告警参数 Alarm parameter
			系统参数 System parameter
			高级参数 Advanced parameter

2.1.2 Main Interface

After the completion of the initialization of the power-on, system automatically enters [main interface] just as shown in the figure below:

Figure 2-2 Main Interface

关闭 Off 随动使能 Tracking enable	等待位 Waiting position 运行状态 Operating state	跟随高度:+1.0mm Tracking height: +1.0mm 最高速度 :+200mm/s Highest speed: +300mm/s 灵敏度等级:10 Sensitivity level: 10
394198	+0.0	等待高度：+1.0 mm Waiting position height:

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信号强度 Signal intensity	Z 轴位置 Z-axis position	+5.0 mm	
上限 Upper limit	下限 Lower limit	跟随 Tracking	穿孔 Punch
急停 Scram	点动上 Inching up	点动下 Inching down	扩展 Expansion

Table 2-2 Descriptions of Main Interface

	Descriptions	**Displayable state**	**Remarks**
Display area of operating state	Off Tracking enable	On	Tracking signal closes and system enters tracking state.
		Off	Tracking signal breaks and system stops tracking
	394198 Signal intensity	Signal intensity	
	Waiting position Operating state	Scram	1. After power-on before returning origin, it is at scram state 2.After system gives an alarm, it is at scram state
		Waiting position	After the power-on of system and returning origin, it is at waiting state
		Punch position	When punch signal closes, floating head reaches punch position
		Tracking position	When tracking signal closes, floating head reaches tracking position
	+0.0	The	

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	Z-axis position	current position of floating head	
Display area of important parameters	Tracking height: +1.0mm	The current set tracking height	Can adjust the height by the real-time way
	Highest speed: +650mm/s	The current set highest tracking height	
	Sensitivity level: 10	The current Sensitivity level	Can adjust the Sensitivity by the real-time way and the smaller the value is, the higher sensitivity is
	Waiting position height: +2.0 mm	The current set waiting height	
Display area of input port state	Upper limit Lower limit Tracking Punch Scram Inching up Inching down Expansion	The current input port state	When input port is effective, indicator light displays green

2.1.3 Calibration Interface

At the state of main interface, press "System calibration", system enters calibration interface, just as shown in the figure below:

Figure 2-3 Calibration Interface

关闭 Off 随动使能 Tracking enable	等待位 Waiting position 运行状态 Operating state	跟随高度:+1.0mm Tracking height: +1.0mm 最高速度 :+300mm/s Highest speed: +300mm/s	
浮头标定 Floating head calibration 伺服标定 Servo calibration	按↑↓键进行功能选择 Press "up" and "down" to choose functions 按 enter 键执行相应功能 Press "enter" to execute corresponding functions		
上限 Upper limit	下限 Lower limit	跟随 Tracking	穿孔 Punch
急停 Scram	点动上 Inching up	点动下 Inching down	扩展 Expansion

Descriptions

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- Floating head calibration: measure the correspondence of the capacitance and position between floating head and panel. Regular calibration can ensure tracking effect.
- Servo calibration: calibrate and compensate null shift of servo motor and usually used at the first power-on

Notes

- If the servo driver and power supply are replaced, servo calibration is needed once again.

2.1.4 Advanced Option Interface

At the main interface, press “advanced options”, system enters advanced option interface, and the interface can set all the parameters of FTC91 Series.

Figure 2-4 Advanced Option Interface

高级选项 Advanced options	
机械参数 Mechanical parameter	告警参数 Alarm parameter
运行参数 Operational parameter	系统参数 System parameter
工艺参数 Technological parameter	高级参数 Advanced parameter

Choose the parameter classification that needs setting through directional buttons; press “enter” and system enters corresponding parameter interface

2.1.4.1 Mechanical Interface

Figure 2-5 Mechanical Parameter Interface

机械参数 Mechanical parameter		
机械参数 Mechanical parameter	伺服类型 Servo type	松下 A5 Panasonic A5 台达 B2 安川Σ-V
输入类型 Input type	丝杆螺距（mm） Lead screw pitch（mm）	10

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输出类型 Output type	每转脉冲数 Number of pulses per round	1000
限位参数 Limit position parameter	速度增益（r/min/v） Speed gain （r/min/v）	0500

Table 2-5 Descriptions of Mechanical Parameter Interface

Parameter Type	Parameter Name	Parameter Function	Default Setting	Optional Setting
Mechanical parameter	Servo type	Set the type of servo motor manufacturers	Panasonic A5	台达 B2 安川∑-V
	Lead screw pitch	Set lead screw pitch of Z-axis. The parameter must be consistent with the one that is actually used	10	1～10
	Number of pulses per round	Set the number of pulses per round that coder feedbacks of servo motor. The number needs be consistent with the parameter of driver	10000	1～20000
	Speed gain	Set the speed gain of servo motor. The parameter must be consistent with speed gain of driver, usually default value is selected.	500	1～5000
Input type	Upper limit input	Set the type of input ports	Normal On	Normal On/ Normal Off
	Lower limit input		Normal On	Normal On/ Normal Off
	Tracking input		Normal On	Normal On/ Normal Off
	Punch input		Normal On	Normal On/ Normal Off
	Scram (return		Normal	Normal On/

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	origin) input		On	Normal Off
	Inching up input		Normal On	Normal On/ Normal Off
	Inching down input		Normal On	Normal On/ Normal Off
	Servo alarm input		Normal On	Normal On/ Normal Off
	Spare use input		Normal On	Normal On/ Normal Off
Output type	System alarm output	Set the type of output ports	Normal On	Normal On/ Normal Off
	Tracking arrival output		Normal On	Normal On/ Normal Off
	Edge detection output		Normal On	Normal On/ Normal Off
	Punch arrival output		Normal On	Normal On/ Normal Off
	cutting head striking panel arrival output		Normal On	Normal On/ Normal Off
	zero-speed clamp output		Normal On	Normal On/ Normal Off
	Servo enable output		Normal On	Normal On/ Normal Off
	Servo alarm output		Normal On	Normal On/ Normal Off

2.1.4.2 Operating Parameters

Table2-3 Descriptions of Operating Parameters

Parameter Type	**Parameter Name**	**Parameter Function**	Default Setting	Optional Setting
Operating Parameters	Starting speed of axis (mm/s)	The higher speed is, the quicker tracking response is. But too high speed may make tracking shake. Adjust a reasonable value as required.	2	1～200
	Highest speed of axis (mm/s)	The highest speed that can be achieved during tracking. The higher the value is, the quicker tracking is.	300	1～1000
	Accelerated speed of axis	The higher the value is, the less time is for servo from	3000	0～50000

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	(mm/ss)	lower speed to highest speed and tracking response speed is higher. Otherwise, the time of accelerated speed is less and the tracking response speed is lower		
	Sensitivity level	During tracking, floating head adjust the sensitivity level dynamically	10	1～15
	Tracking compensation (um)	As for too high tracking speed causes servo overshoot and cause shacking, the compensation parameter is set. Usually the higher tracking response is, the value is higher, Other wise, the value is smaller	50	1～9999
	Tracking allowance (um)	The parameter is the precision of response tracking. The higher the value is, the poorer precision of response tracking is, but it is less likely for system to shake	20	0～999
Inching parameter	Inching speed (mm/s)	The speed during manual control on motor operation	10	1～1000
	Inching step distance (mm)	The distance that each inching moves during manual control on motor operation	+0.5	0.1～10.0
Home parameter	Power-on return origin	After setting “Yes” and power-on, control floating head to return origin	No	Yes/No
	（ mm/s ） Back to original speed (mm/s)	Speed that system returns origin	100	1～1000
	Back to zero with slow speed (mm/s)	System leaves hard upper limit speed; the position after leaving is considered as origin of coordinate, so the value is less and it can	5	1～1000

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		ensure the precision of origin of coordinate		
	Origin offset position(mm)	Set the offset of origin hard upper limit	0.5	0～100.0
Limit position parameter	Soft limit position protection	After setting “ Yes”, once system touches soft limit position, protection begins	Yes	Yes/No
	Soft limit position lower limit(mm)	Set soft lower limit position; negative value indicates it is above origin	100.0	-999.9 ～ 999.9

2.1.4.3 Technological Parameters

Table2-4 Descriptions of Technological Parameters

Parameter Type	**Parameter Name**	**Parameter Function**	Default Setting	Optional Setting
Technological parameters	Calibration height (mm)	Set tracking height	1.0	0.1～10.0
	Stop coordinate(mm)	Set stop coordinate of floating head; the value is the distance deviates origin.	5.0	0.1～999.9
	Striking plate protection	Set whether to open the function of striking plate protection or not	On	On/Off
	Striking plate time-delay (ms)	Set the duration after striking plate; Once it exceeds duration, system protects at once.	200	0～5000
Punching parameter	Punching way	Set punching way	Section punching	Section punching/ Progressive punching
	Punching height (mm)	Set punching height	3.0	1～10
	Progressive punching time (ms)	when punching way is set into	200	0～9999

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		progressive punching, the parameter indicates the time needed from the punching position to tracking position		

2.1.4.4 Alarm Parameters

Table2-5 Descriptions of Alarm Parameters

Parameter Type	**Parameter Name**	**Parameter Function**	Default Setting	Optional Setting
Alarm parameters	Coder alarm enable	The parameter is set “Yes”, after giving out coder alarm, system indicates	Yes	Yes/No
	Off-connection alarm enable	The parameter is set “Yes”, after giving out off-connection alarm, system indicates	Yes	Yes/No

2.1.4.5 System Parameters

Table2-6 Descriptions of System Parameters

Parameter Type	**Parameter Name**	**Parameter Function**	Default Setting	Optional Setting
Version information	Software version	Describe current software version	Current software version	None
	Hardware version	Describe current hardware version	Current hardware version	None
Network setting	Network port	Set network IP, has not been started temporarily	None	None

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Language setting	Language selection	Set system language	Chinese	None
Shortcut menu	All parameters (such as starting speed of axis, accelerated speed of axis, etc)	Define all the selected parameter into shortcut menu. It is convenient to operate	Cancel	Cancel /define

2.1.4.5 Advanced Parameters

Table2-7 Descriptions of Advanced Parameters

Parameter Type	**Parameter Name**	**Parameter Function**	Default Setting	Optional Setting
Advanced parameters	System restart	After choosing “Yes”, system restarts	No	Yes/No
	Revert to factory setting	After choosing “Yes”, system parameters revert to factory values	No	Yes/No
	Frequency debugging	Set the frequency of preamplifier. Usually it doesn’t need setting	083	0～999
	Button buzzing indication	After setting “Yes”, button gives indication sound	Yes	Yes/No
	Starting indication help information	After setting “Yes”, each starting indicates help information	Yes	Yes/No
	Disabled motion function (effective after restarting)	。 After setting “Yes” and restarting, system always maintains disabled state	No	Yes/No

2.1.5 Shortcut Menu Interface

At the main interface, press “shortcut menu”, system enters the interface.

In shortcut menu interface, there is user-defined shortcut setting parameters (at most 5 parameters can be defined), which is convenient for users to set required parameters rapidly during debugging device.

Figure 2-6 Shortcut Menu Interface

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快捷菜单 20.0	Shortcut menu
轴起始速度(mm/s) 0025	Starting speed of axis(mm/s) 0025
轴最高速度(mm/s) 0500	Highest speed of axis(mm/s) 0500
轴加速度(mm/s) 08000	Accelerated speed of axis(mm/s) 08000
右键：警告信息	Right button: alarm information



Tips

- At shortcut menu, press “right button”, users can check current alarm information
- The figure nearby the title of shortcut menu refers to the value of current temperature

2.2 Function Description

2.2.1 Functions of Tacking Control

FTC91 Series measures the capacitance formed between the nozzle of floating head and metal artifacts through preamplifier and uses the corresponding relationship between capacitance value and distance to control of the float up or down of Z axis in real-time way, and ensure relative distance between parts is constant.

FTC91 Series adopts professional anti-interference design, supports the micro gap tracking of floating head and plate; at the same time, it adopts the temperature compensation algorithm, guarantees tracking height and stability are not affected under the condition of severe changes in the environment temperature.

Figure 2-8 Tracking Performance Index of FTC91 Series

Performance Index	Value	Remarks
Sampling frequency	2K	
Tracking ranges	0.2mm—5mm	
Highest tracking speed	650mm/S	
Tracking	0.01mm	Can be set by sensitivity

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response precision		
Repeated positioning accuracy	0.01mm	
Calibration way	Automatic	One-button calibration is convenient and quick

2.2.2 Functions of Section/ Steeper Punch

Punching function is mainly used for cutting thick plates, which can effectively control the rate of blasting hole in the process of cutting and improve the cutting quality.

FTC91 Series provides a “punch” signal input and a punch arrival signal output. After numerical control system closes punching signal, FTC91 Series controls floating head to reach punching position (the height is settable), and output punching arrival signal to numerical control system, and begin to punch.

FTC91 Series supports section punching and progressive punching. Punching parameters are located in the “advanced options” - > “technological parameters”. Users can butt join it with mainstream NC (PA8000, Baichu and Weihong) in the market according to actual cutting process, and complete section and progressive punching

Figure2-7 Setting Options of Technological Parameters of Punching

工艺参数 Technological parameters	穿孔方式 分段穿孔 Punching way: section punching
工艺参数 Technological parameters	穿孔高度(mm)03.0Punching height(mm): 03.0
穿孔参数 Punching parameters	渐进穿孔时间(ms) 0200 progressive punching time(ms): 0200

2.2.3 Functions of Abnormal Alarm Protection

FTC91 Series has perfect alarm indication and protective measures for the possible failure in the process of the practical work, and can inform the NC system through output port, to take further protection, such as scram, etc, which can effectively prevent the damage of faulty operation on operators and equipment.

Figure 2-9 List of Alarm Information

Alarm Name	Triggering condition	Remove method
Servo input alarm	The cable of servo motor is not well	The cable of servo motor and driver is normally connected

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	connected	
Abnormal alarm of coder	The Z-axis motor doesn't operate on the given command.	After system pre-heat for 2 minutes and make servo calibration
Abnormal alarm of signal line	The signal line of controller and amplifier is not connected or not well connected	Check the connection of signal line; ensure the signal line between nozzle of cutting head and amplifier, the signal line between amplifier and controller is normally connected
Hard upper limit alarm	Touch the travel switch of hard upper limit of Z-axis	Floating head breaks away from the travel switch of hard upper limit of Z-axis
Hard lower limit alarm	Touch the travel switch of hard lower limit of Z-axis	Floating head breaks away from the travel switch of hard lower limit of Z-axis
Soft upper limit alarm	Touch soft upper limit of Z-axis	Floating head breaks away from the soft upper limit of Z-axis
Soft lower limit alarm	Touch soft lower limit of Z-axis	Floating head breaks away from the soft lower limit of Z-axis
Striking plate alarm	During tracking, floating head strikes sheet metal and duration is longer than the set value	Floating head breaks away from sheet metal

2.2.4 Functions of Shortcut Setting of Important Parameters

As for FTC91 Series, more parameters are settable, which is convenient for users, and system provides the quick setting function of important parameters. Users can define the frequently-used parameter in shortcut menu (up to 5 ones), which is very convenient and quick in the daily debugging.

Figure 2-8 Shortcut Parameter Setting

系 统 参 数 System parameter		
版 本 信 息 Version information	轴起始速度 Starting speed of axis	定义 Define

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网络设置 Network setting	轴最高速度 Highest speed of axis	定义 Define
语言设置 Language setting	轴加速度 Accelerated speed of axis	定义 Define
快捷菜单 Shortcut menu	灵敏度等级 Sensitivity level	取消 Cancel
	随动补偿 Tracking compensation	取消 Cancel
	点动补偿 Inching compensation	取消 Cancel
	点动步进距离 Inching step distance	取消 Cancel

快捷菜单 Shortcut menu	
轴起始速度(mm/s)Starting speed of axis(mm/s)	0025
轴最高速度(mm/s)Highest speed of axis(mm/s)	0050
轴加速度(mm/ss)Accelerated speed of axis (mm/ss)	08000
左键：帮助信息 Left button: help information 右键：告警信息 Right button: alarm information	

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3 Installation & Connection

3.1 Pre-installation Preparation

3.1.1 Safety Precautions

Follow all safety precautions

In order to ensure personal and equipment safety, during installation, operation and maintenance of equipment, please follow all the safety precautions in the marks of equipment and instructions in the manual. In the Manual, “safety warning”, “note”, “instructions”, do not represent all the safety items that should be followed, which are only supplement of all the safety precautions.

Follow Local Statues & Specifications

During operation, local statues and specifications should also be followed.

Requirements on Personnel

Personnel who are in charge of installation, operation and maintenance of equipment must read materials carefully first and master proper operation methods and safety precautions before they install, operate and maintain equipment.

Personal Safety

During the operation of connection, tools should be insulating treated and insulating gloves should be worn so as to avoid getting an electric shock. In order to avoid the dust during punch from entering people’s respiratory tract or fall into eyes, operators should adopt corresponding protective measures.

3.1.2 Preparation of Tools

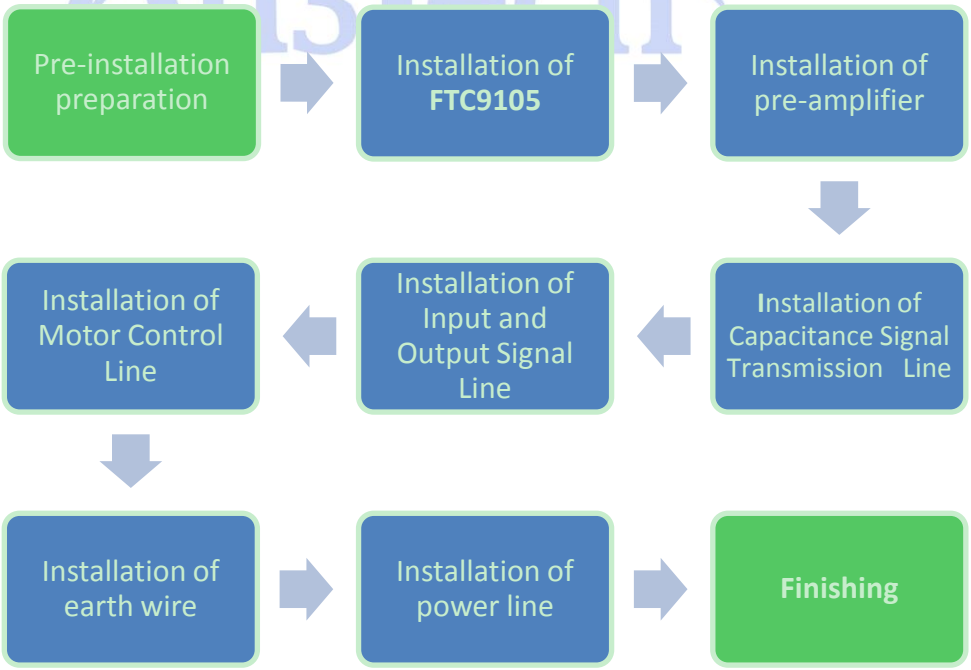
Table 3-1 List of Tool Preparation

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Tool Name	Picture	Main Functions
Universal meter		Check electrical connection and electric parameter
Cross screwdriver		Connect cable and fasten screw
Wire stripper		Make cable contact

3.2 Process of Installation & Connection

Figure 3-1 Installation and Connection Flow Diagram of FTC91 Series



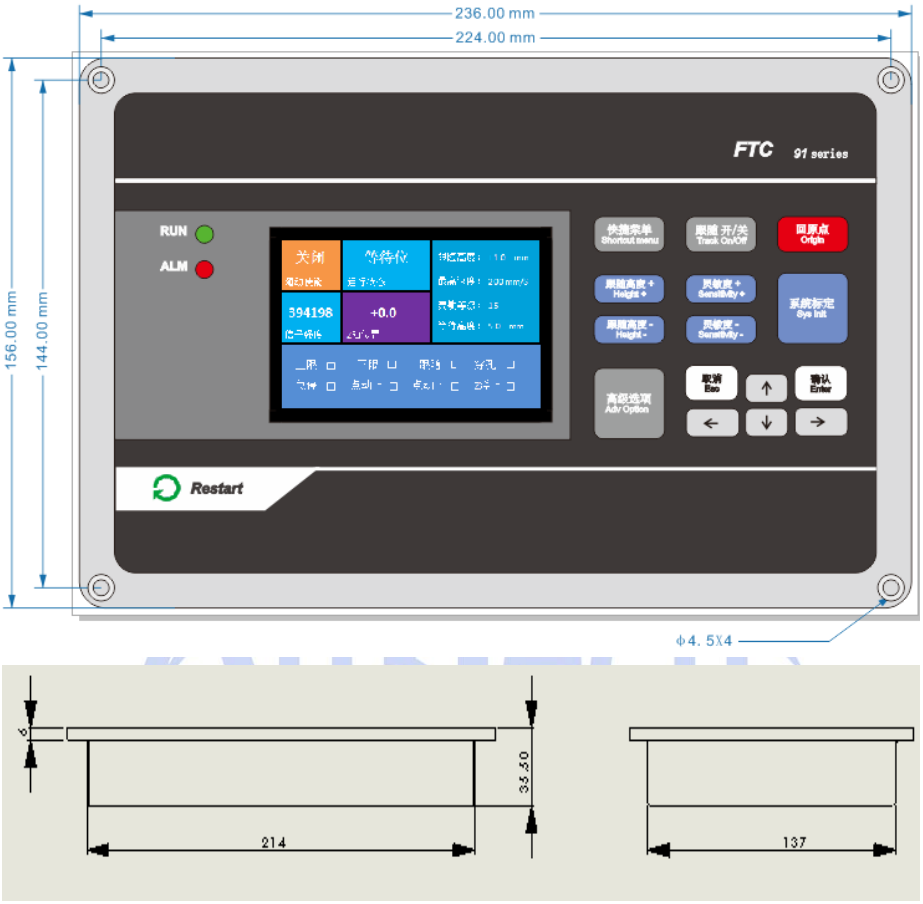
3.3 Installation

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3.3.1 Installation of FTC91 Series

Control box of FTC is quite convenient and quick to install, which can be installed on users' control panel or the Longmen side of machine tool or near Z-axis motion, according to actual situations.

Figure 3-2 Installation Dimension of Floating Head of FTC91 Series

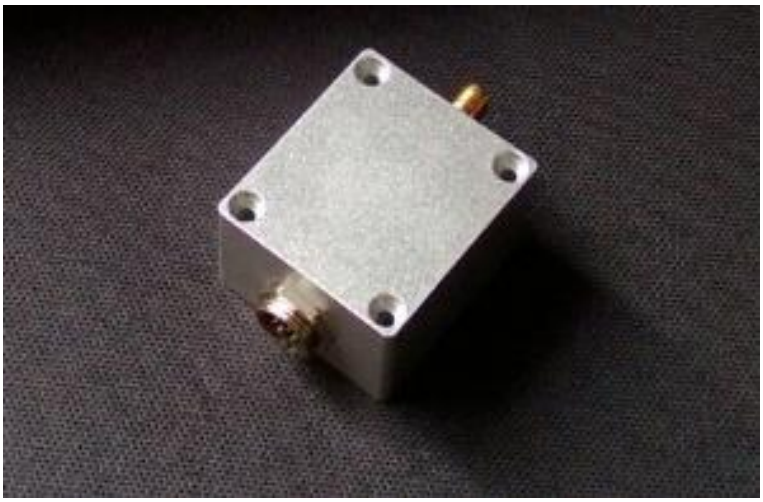


3.3.2 Installation of Preamplifier

The main function of preamplifier is to transform and process the acquired capacitance signal and transmit the transformed signal to the FTC controller for closed-loop control. Preamplifier adopts unique hardware anti-interference design, which ensures that the acquired capacitance signal stable after long distance transmission without attenuation

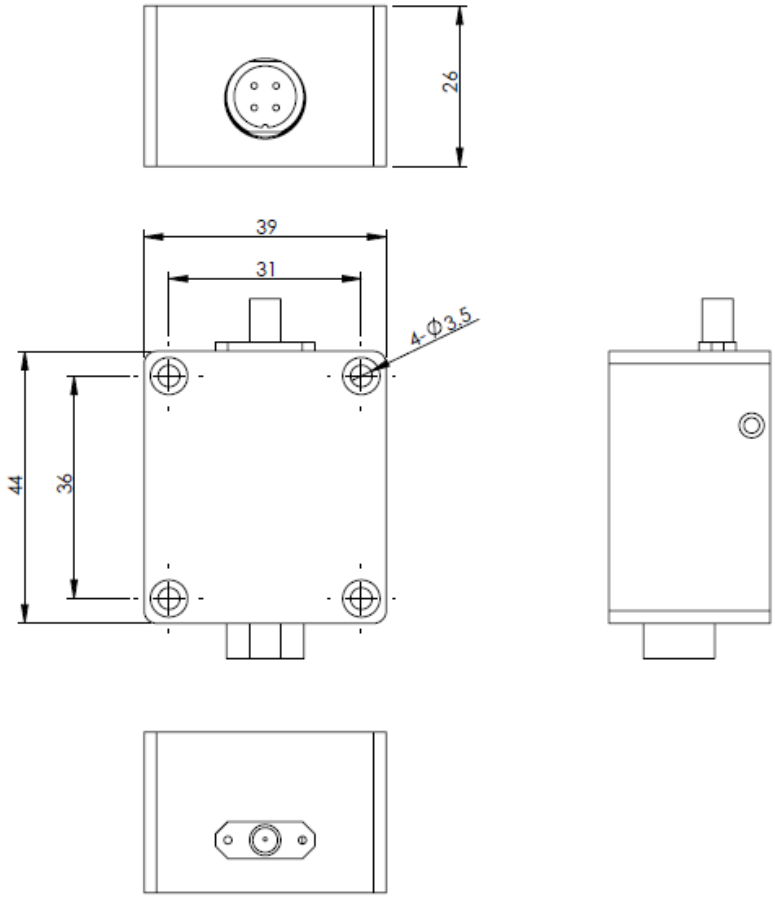
Figure 3-3 External View of Preamplifier

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Preamplifier is small and beautiful, and it is flexible for installation. When overall scheme of Olson cutting head is used, preamplifier has been installed on cutting head before delivery. If users only adopts control box of FTC91 Series, it is suggested to install the preamplifier in the suitable position of floating head.

Figure 3-4 Installation Dimension of Preamplifier



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3.4 Connection

3.4.1 Installation of Capacitance Signal Transmission Line

1. Connect nozzle of floating head and preamplifier with RF capacitance signal line (10mm)
2. Connect port of FTC91 Series Sensor with the air plug connect of preamplifier with signal transmission line (standard configuration 15m)

3.4.2 Installation of Input and Output Signal Line

FTC91 Series has much input and output resource, including 8 input ports and 6 output ports, 1 analog quantity input and 2 analog quantity outputs.

Among the 8 input ports, 7 ones have been defined, respectively are “upper limit/ UP”, “lower limit/ DOWN”, “tracking/LA”, “punch/DH”, “return origin”, “inching lift” and “inching decline” and another one is expand input port, which can be extended as required.

Among the 6 output ports, 4 ones have been defined, respectively are “striking plate alarm”, “tracking arrival”, “edge detection” and “punch tracking arrival” and another one is expand input port, which can be extended as required.

FTC91 Series can butt join with numerical control system through input/output port and it can complete various kinds of process actions perfectly, such as section/progressive punching, striking plate and protection, etc. input/output port is shown in the figure below:

Figure 3-5 Input/ Output Port (DB25 Male)

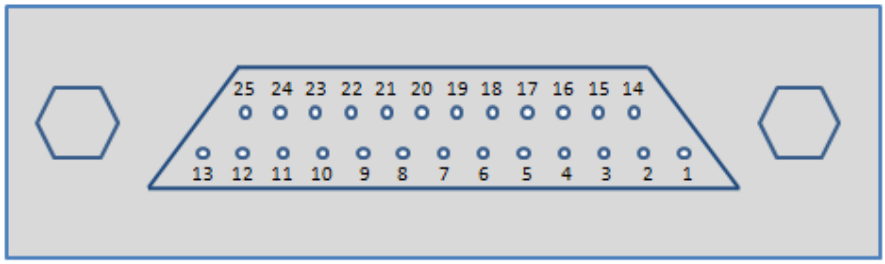


Table 3-2 Definitions of Base Pin of Input/ Output Port Function

Pin	Signal Name	Function		Pin	Signal Name	Function
1	0V	Power supply earth		14	K1	Alarm output
2	UP	Upper limit signal		15		
3	DOWN	Lower limit signal		16	K2	Tracking arrival
4	LA	Tracking signal		17		

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5	DH	Punching signal		18	K3	edge detection signal
6	ORG	Return origin signal		19		
7	DI1	Inching lift		20	0V	Power supply earth
8	DI2	Inching decline		21	K4	punch tracking arrival
9	DI3	Expand input No.3		22		
10	AI1	Analog input		23	K5	Spare output
11	AO1	Analog quantity output No.1		24		
12	AO2	Analog quantity output No.2		25	24V	24V power supply output
13	AGND	Analog quantity earth				

Descriptions

- The default seeting of input port is normal on and the default seeting of output port is normal off. When connected with numercial control system or upper computer, it can be set as required
- It can be complettly butt joined with numercial control system of mainstream cutting machine through input/output port and achieve various kinds of cutting actions.
- The secial pin board and accessory of FTC91 Series can achieve quick installation and avoid the trouble of field bonding wire (refer to Chapter Five Aeecssory).

3.4.3 Installation of Motor Control Line

FTC91 Series can match with many kinds of servo motors, including Panasonic, Delta, etc. As for Z-axis tracking system of laser cutting with small and medium power, Panasonic 200/400W universal servo motors are recommended.

Figure 3-7 Servo Motor Control Port (DB15 Female)

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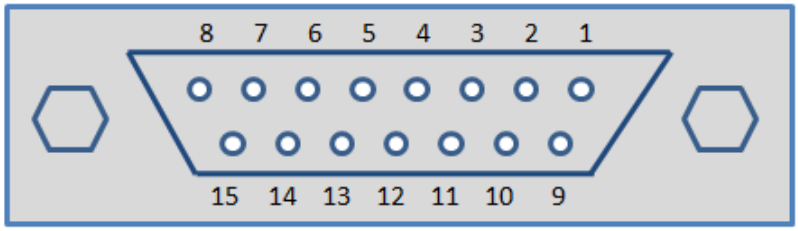
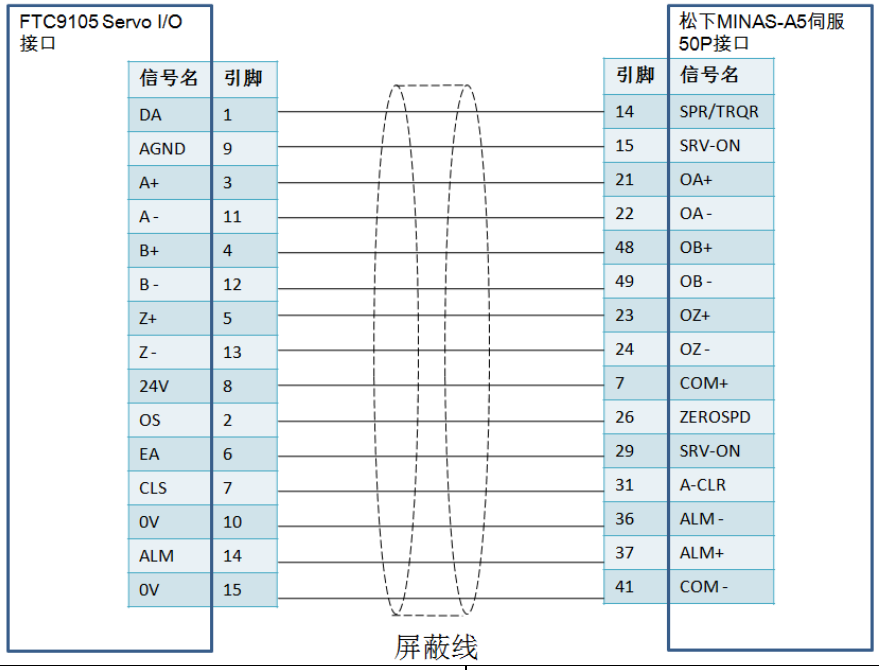


Table 3-2 Definitions of Base Pin of Servo Motor Control Port

Pin	Signal Name	Function		Pin	Signal Name	Function
1	DA	+-8V analog quantity output		9	AGND	Simulation earth
2	OS	Zero-speed clamp		10	0V	Power supply earth
3	A+	A phase positive of coder		11	A-	A phase negative of coder
4	B+	B phase positive of coder		12	B-	B phase negative of coder
5	Z+	Z phase positive of coder		13	Z-	Z phase negative of coder
6	EA	Servo enable		14	ALM	Alarm signal
7	CLS	Alarm clearance		15	0V	Power supply earth
8	24V	Power supply output				

Figure 3-8. Butt Joint Graph of FTC91 Series and Panasonic Servo Driver

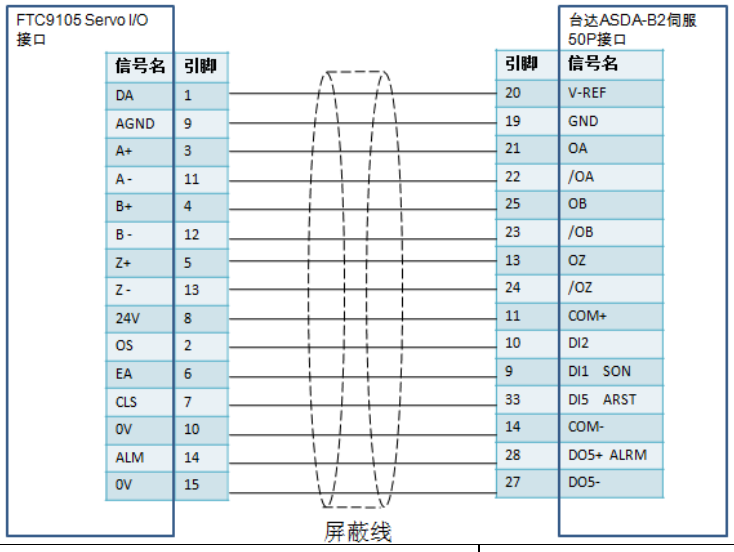
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FTC91 Series Servo I/O 接口	Servo I/O port of FTC91 Series
信号名	Signal name
引脚	Pin
屏蔽线	Shielded line
引脚	Pin
信号名	Signal name
松下 MINAS-A5 伺服 50P 接口	50P port of Panasonic MINAS-A5Servo driver

Figure 3-9. Butt Joint Graph of FTC91 Series and Delta Servo Driver

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FTC91 Series Servo I/O 接口	Servo I/O port of FTC91 Series
信号名	Signal name
引脚	Pin
屏蔽线	Shielded line
引脚	Pin
信号名	Signal name
台达 ASDA-B2 伺服 50P 接口	50P port of Delta ASDA-B2 Servo driver

Description

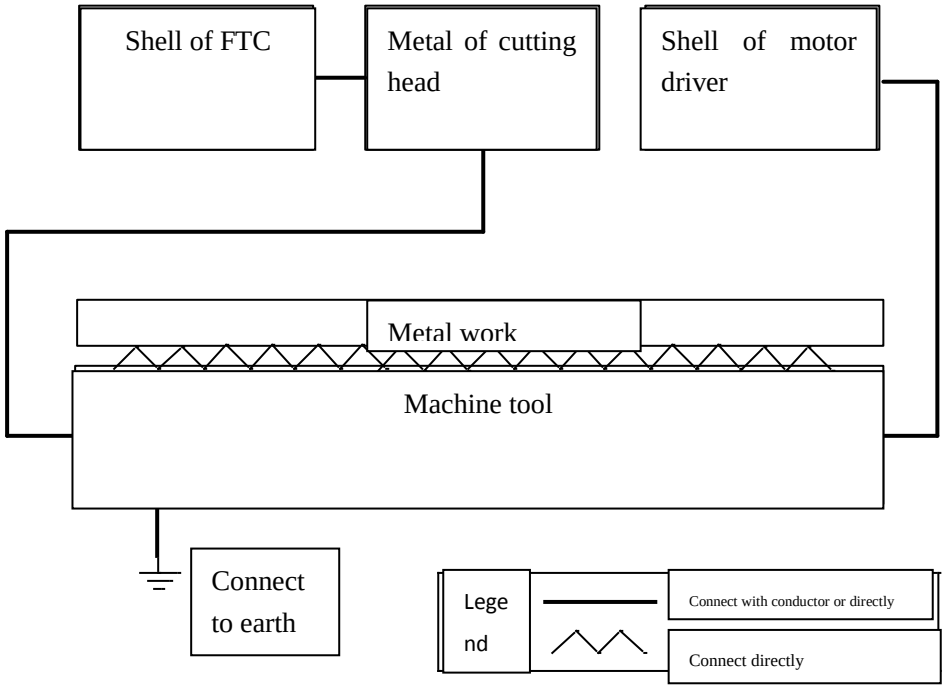
- The secial pin board and accessory of FTC91 Series can achieve quick installation and avoid the trouble of field bonding wire (refer to Chapter Five Aeecssory).

3.4.4 Installation of Earth Wire

Since FTC adopts capacitance ranging principle, it has strict requirements on system earthling. FTC metal shell and metal parts of cutting head, and metal parts of machine tool as well as box shell of motor driver, metal parts of machine tool and metal work must keep the equipotential connection (connect directly and mutually through conductor).

Figure 3-10 Sketch Map of System Earthling of FTC

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Notes

- The earth point of FTC must connect with metallic work well, or the capacitance measurement accuracy is seriously impacted.
- Metallic work connects with earth by laser machine tool; the earthling standard should accord with international requirements.

3.4.5 Installation of Power Line

FTC91 Series supports power supply of DC12V or DC24V. Please introduce V+ and V- output from 12V or 24V power module and connect them respectively with power port+ and -.

== Installation is over ==

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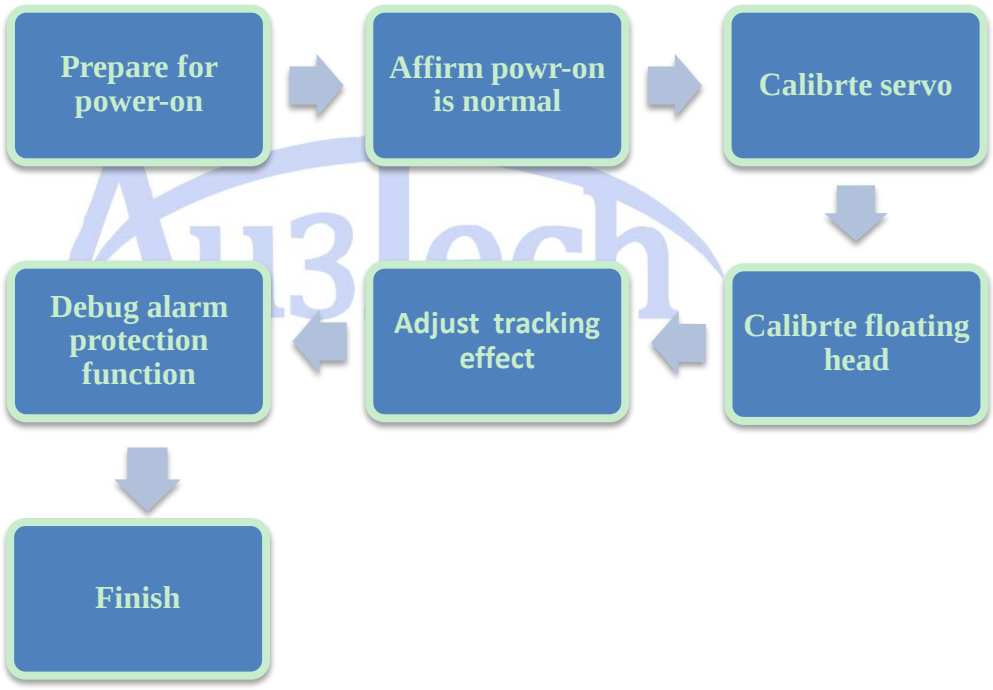
4 Debugging

Notes

- Please read the character carefully before debugging and start power-on operation after having mastered it.
- Please be sure to refer to the debugging steps for the first use.

4.1 Debugging Steps

Figure 4-1 Flow Diagram of Debugging of FTC91 Series



4.2. Power-on Preparation

1. After installing FTC91 Series and its subsidiary equipment, please check the cable connection is correct and reliable by universal meter and whether DC power supply output voltage meet the ranges of operating voltage of various components and affirm whether all terminal connectors and screws are tighten up.
2. Adjust floating head to the center of travel
3. FTC91 Series adopts the speed model to control servo motor so before the power-on, related parameters of servo driver have to be set up and saved; users

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need to complete setting according to the selected brand.

As for Panasonic 200 W universal servo motor, the following parameters need being set up.

Table 4-1 Parameter Setting of Panasonic 200 W Universal Servo Motor Driver

Parameter	Default	After setting	Meaning
PR001	0	1	Motor control mode must set into speed mode
PR003	13	17	As for servo rigidity, if the rigidity is set too small, motor is more likely to overshoot; if it is set too large, the noise of motor operation increases and tends to emit heat
PR302	500	500	Input speed order gain
PR315	0	1	Open zero-speed clamping function

As for Delta ASDA-B2 servo motor, the following parameters are need being set up:

Table Parameter Setting of Delta 200W ASDA-B2 Servo Motor Driver

Parameter	Set Value	Meaning
P1-01	002	Motor control mode must set into speed mode
P1-38	2000	Set the zero-speed clamping value maximum
P1-40	5000	The speed gain that corresponds to height controller is500 r/v/min
P2-10	101	DI1 is set SON servo enable and logic is normal On
P2-11	105	The parameter of Delta 200W ASDA-B2 servo motor driver is set as 105
P2-12	114	Set speed order into external analog quantity control
P2-13	115	Set speed order into external analog quantity control
P2-14	102	DI5 is set into ARST clearance alarm function and logic is normal On.
P2-15	007	
P2-16	007	
P2-17	007	
P2-22	007	DO5 is set into ALRM servo alarm function and logic is normal Off.

After ensuring all are proper, switch the power supply to power on the system.

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4.3Affirmation of Normal Power-on of FTC

1. After FTC6105X is normally powered, buzzer gives out “tick” twice. LCD is lit up and startup interface enters the main interface of system automatically. Users can browse help information according to indications and also can press “Esc” to exit help interface and enter main interface.
2. Indicator light of Green RUN begins twinkling.

Note

- 1. If red light blinks, please check corresponding alarm information; after alarm is clear, keep on next step. Check whether servo motor is not well connected, and the normal On/Off type of upper limit/ lower limit travel switch is properly set up or not.
- 2. The improper setting of the parameter of lead screw pitch influences actual operation speed.
- 3.If users want to system to enter main interface directly after power-on, users can set “advanced option” -> “advanced parameter” -> “starting indication help information” into “No”

4.4 Servo Calibration

FTC91 Series adopts speed mode to control the motion of servo motor. After the first power-on of system, servo motor driver needs pre-heat for 2 minutes before servo calibration.

1. Press “system calibration” and choose “servo calibration”
2. Press “Enter” and then make servo calibration; after successful calibration, save it and exit.

Figure 4-2 Explanatory Chart of Servo Calibration



关闭 Off 随动使能 Tracking enable	等待位 Waiting position 运行状态 Operating state	跟随高度:+1.0mm Tracking height: +1.0mm 最高速度:+300mm/s Highest speed: +300mm/s
浮头标定 Floating	按↑↓键进行功能选择	Press “up” and “down” to choose functions

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head calibration 伺服标定 Servo calibration	按 enter 键执行相应功能 Press “enter” to execute corresponding functions		
上限 Upper limit	下限 Lower limit	跟随 Tracking	穿孔 Punch
急停 Scram	点动上 Inching up	点动下 Inching down	扩展 Expansion

提示 (请确保伺服电机上电超过 2 分钟)	Indication (please ensure the time of power-on of servo motor exceed 2 minutes)
确定	Yes
取消	No

标定成功	Successful calibration
确定	Yes

Note

- 1. Servo calibration is used for the first power-on. After successful calibration, the following debugging doesn’t need servo calibration
- 2. If the servo driver and power supply are replaced, servo calibration need be done again.

4.5 Floating Head Calibration

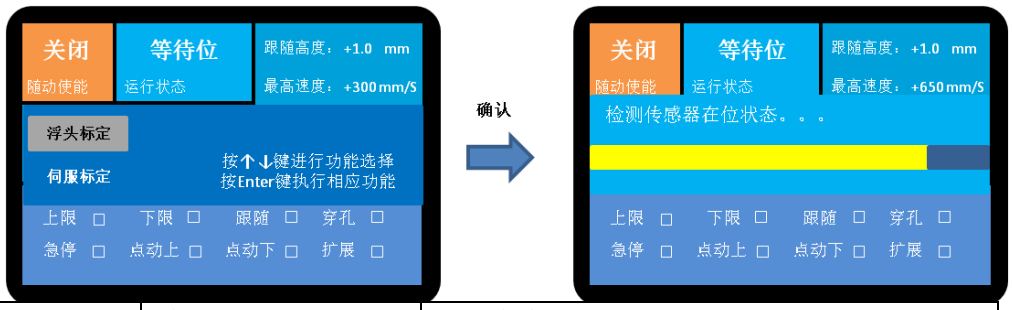
1. Before the affirmation of calibration of floating head, please the metal plate below floating head is flat and well connected with earth.

2. Press “return origin” to ensure floating head returns to origin and affirm operating state is “waiting position”

3. Press **“system calibration**” and choose “**floating head calibration**” and then press “Enter” to calibrate. During calibration, please ensure machine tool is state and vibration-free and never bring man-made interference, or the effect is affected and shaking occurs in tracking process.

Figure 4-3 Explanatory Chart of Servo Calibration Process

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关闭 Off 随动使能 Tracking enable	等待位 Waiting position 运行状态 Operating state	跟随高度:+1.0mm Tracking height: +1.0mm 最高速度:+300mm/s Highest speed: +300mm/s	
浮头标定 Floating head calibration 伺服标定 Servo calibration	按↑↓键进行功能选择 Press “up” and “down” to choose functions 按 enter 键执行相应功能 Press “enter” to execute corresponding functions		
上限 Upper limit	下限 Lower limit	跟随 Tracking	穿孔 Punch
急停 Scram	点动上 Inching up	点动下 Inching down	扩展 Expansion

确认	Yes
检测传感器在位状态	Detecting the position state of sensor

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1. After completing calibration, set “operating parameter” -> “power-on and return origin” into “Yes” and the calibration ends
2. Press “tracking On/Off” or press “tracking” at the numerical control software, floating head begins tracking.

Description

- The parameter “power-on and return origin” is default set into “No” mainly to avoid the great speed at the first power-on and return origin from causing accidental injury on operators. After completing calibration, set it into “Yes”

4.6 Adjustment of Tracking Effect

1. Set soft upper/lower limit position according to actual situations. The value indicates the distance that deviate origin. The negative vale indicates the position is above origin.

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Figure 4-4 Soft Upper/Lower Limit Setting

运行参数 Operating parameter	
运行参数 Operating parameter	软限位保护 是 Soft limit position protection Yes
点动参数 Inching parameter	软限位下限(mm) 100.0 Lower limit of soft limit position(mm) 100.0
回原参数 Return origin parameter	
限位参数 Limit position parameter	

2. Set tracking speed, which can be adjusted in operating parameter. By the coordination of “starting speed of axis”, “highest speed of axis”, “accelerated speed of axis”, “tracking compensation” and “tracking allowance”, the ideal tracking speed can be set. The default vale before delivery suits most cases, so usually it doesn’t need adjusting.

Figure -4 Tracking Speed Parameter Setting

运行参数 Operating parameter	轴起始速度(mm/s) 02 Starting speed of axis (mm/s) 02
运行参数 Operating parameter	轴最高速度(mm/s)300 Highest speed of axis (mm/s) 300
点动参数 Inching parameter	轴加速度(mm/ss)03000 Accelerated speed of axis (mm/ss) 03000
回原参数 Return origin parameter	灵敏度等级 10 Sensitive level 10
限位参数 Limit position parameter	随动补偿(um)050 Tracking compensation(um) 050
	随动容差(um)020 Tracking allowance (um)020

3. Set tracking height, stop position of floating head and punching way, etc so as to achieve the best tracking effect

Figure 4-5 Technological Parameter Setting

工艺参数 Technological parameter	标定高度(mm) 01.0 Calibration height (mm) 01.0
工艺参数 Technological parameter	停靠高度(mm)005.0 Stop height (mm) 005.0

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穿孔参数 Punching parameter	撞板保护 是 Striking plate protection Yes
	撞板延时(ms) 0200 Striking plate time-delay (ms) 0200

Description

- The three parameters of starting speed of axis, accelerated speed of axis and highest speed of axis play a decisive role in tracking speed

Tips

In order to make the stop height setting and soft lower limit position more convenient and quick, FTC91 Series supports real-time setting of them. The steps are as follows:

1. At the main interface of system, press “Enter” and enter coordinate parameter shortcut setting interface

Figure 4-6 Coordinate Parameter Shortcut Setting Interface

坐标参数快捷设置	Coordinate parameter shortcut setting
将 z 轴位置 xxx 设置为如下参数：	Set the position of Z-axis into the following parameters:
停靠坐标(mm) 005.0	Stop height (mm) 005.0
软限位下限(mm) 100.0	Lower limit of soft limit position(mm) 100.0

2.Press “UP” and “Down” manually and adjust floating head to the required position; after pressing “Enter”, the current position can be set into stop position or lower limit of soft limit position. It needs noting that the “soft limit position protection” should be set into “No” before setting lower limit of soft limit position

4.7 Alarm Protection Function Debugging

When FTC91 Series gives an alarm, the red light (ALM) of system is normal On, and control floating head quickly lifts to stop position; at the same time, the state of alarm output signal changes, and after numerical control system detects alarm signal, users can turn it off to protect the safety of personnel and equipment.

1. Ensure the connection of alarm output line and floating head alarm input port of numerical control system is proper. The alarm output of FTC91 Series is the

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No.14 and No. 15 pin of I/O Port

2. Set the normal On/Off state of alarm output port, which should be consistent with numerical control system, or the conditions of triggering alarm are overturned. The default is normal On
3. Trigger any alarm, such as servo alarm, striking plate to check whether the alarm protection of FTC91 Series and numerical control system is normal. If it is normal, the debugging is successful; if it is abnormal, please check whether the above two steps are finished as required.

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5 Accessories

5.1 Accessory List

Capacitance height controller system of FTC91 Series provides related accessories to ensure users can complete installation conveniently and quickly. The option of accessories should based on actual need

表 5-1 附件详细列表 Table 5-1 Detailed List of Accessories

Serial No.	Accessory Name	Specification	Quantity	Configuration Scheme	Picture	Remarks
1	Capacitance signal line	10mm	1	Necessary		Used to connect floating head and preamplifier
2	Signal transmission line	15m black shielded line	1	Necessary		Used to connect preamplifier and FTC91 Series
3	Special pin board	127mm(length) X 123mm(width)	1	Optional		Used to connect servo driver and board card of numerical control
4	Servo driver connecting line	1m CN50 black shielded line	1	Optional		Used to connect 50P port of servo driver and 50P port of pin board
5	Servo I/O port connecting line	1m DB15 black shielded line	1	Optional		Used to connect DB15 port of pin board and DB15 servo

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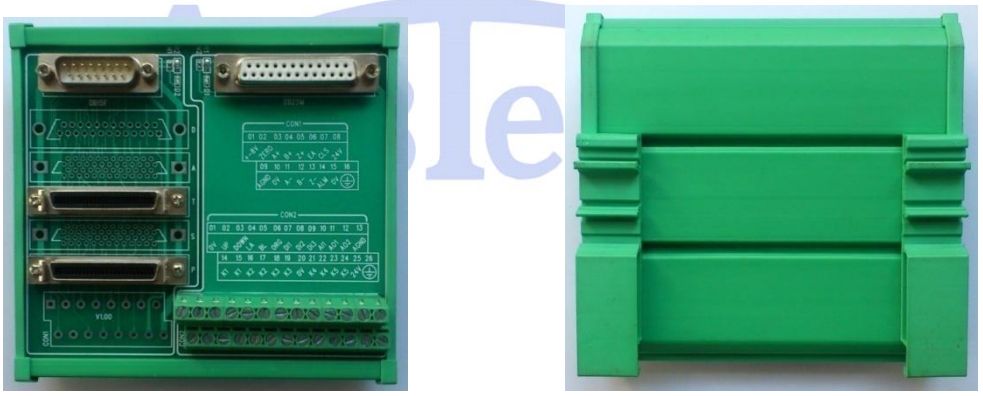
						port of FTC91 Series
6	I/O port connecting line	1m DB25 black shielded line	1	Optional		Used to connect DB25 port of pin board and DB25 I/O port of FTC91 Series

5.2 Descriptions of Pin Board

5.2.1 Installation Dimension of Pin Board

The dimension of pin board is 127mm(length) X 123mm（width），and it supports standard 35mmguide rail installation

Figure 5-1Actual Picture of Pin Board



Front view **Rear view**

5.2.2 Port Descriptions of Pin Board

Figure 5-2 Sketch Map of Pin Board Port

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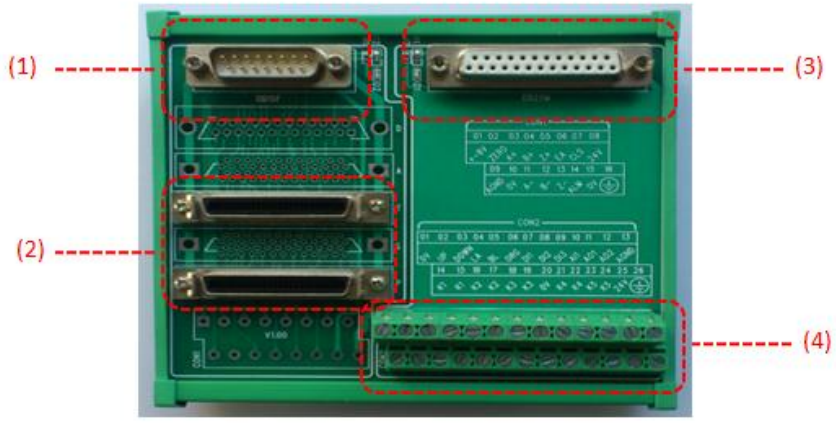


Table 5-2 Descriptions of Pin Board Port

Serial No.	**Port Name**	**Descriptions**	**Remarks**
（1）	DB15 port	Butt join with controller through “Servo I/O port connecting line”	
（2）	CN50 port	Butt join with servo motor driver through “servo driver connecting line”	The letter at the right side of port indicates different motor manufacturer: P: Panasonic; T: Delta. Users can connect corresponding port according to the motor they use
（3）	DB25 port	Butt join with controller through “I/O port connecting line”	
（4）	IO connecting line port	Butt join with board card of numerical control through lines that users provide	As for the definition of each terminal, please refer to the Section 3.4.2 of Chapter Three

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6. Operation and Maintenance

6.1 Daily Maintenance

1. Regularly check the fastening of the connection of co-axis cables between sensing parts (nozzle) of capacitance and FTC (once each week); for any loosening, please fasten it at once, or the measurement results are affected.
2. Regularly check the oxidation and wearing of the sensing parts (nozzle) of capacitance (once each month); for any serious oxidation and wearing loosening, please replace it at once, or the measurement results are affected.
3. Regularly observe the states of indicator light of FTC (once each month); if light ALM is normal on, it indicates parts of FTC fail.

6.2 Failure Process

Figure 6-1 Common Failure Process

Fault phenomenon	**Possible causes**	**Processing method**
Motor can operate but drive structure cannot operate	The connection between motor and drive structure is loose	After power-off, check the connection between motor and drive structure
After the power-on of system, display colder gives an alarm. aft	For the first power-on, servo motor is not preheated and servo calibration is not done	Preheat servo motor for 2 minutes and then make servo calibration
After of system, floating head always lifts rapidly to hard upper limit position, servo driver gives an	For the first power-on, servo motor is not preheated and servo calibration is not done. The parameter of	Preheat servo motor for 2 minutes and then make servo calibration Set the parameter of “power-on and return origin” into “No” Press “return origin”

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alarm	“power-on and return origin” is set into “Yes”	
After power-on and pressing “return origin” floating head always lifts rapidly to hard upper limit position, servo driver gives an alarm	Upper limit travel switch doesn’t function.	Check whether upper limit travel switch can normally operate and whether the butt joint with controller of FTC91 SERIES is proper
After system enters the states of normal operation, and closing tracking signal (LA), cutting head moves upwards or vibrates upwards and downwards.	1.Capacitance signal line is loose 2.Not well connected with earth	1.Check whether the connection line of capacitance signal and cutting head is loose and check whether the connection line of capacitance signal and preamplifier is loose 2.Check the earthling of system
After system enters the states of normal operation, capacitance signal is always weak and beating about 10.	1. The copper nozzle of floating head breaks over earth. 2 The system is not calibrated.	1.Check the earthling with universal meter and check whether there is a short circuit between line core of capacitance signal line and earth 2. after ensuring the copper nozzle of floating head doesn’t break over earth, calibrate floating head
The tracking height of system is far from the set value Cutting head moves upwards or vibrates upwards and downwards within tracking height.	1.The connection of nozzle and co-axis line of FTC loosens; 2.Mechanical parameter is not matched with actual situation 3.Operating parameter is not properly set up	1.Check whether the connection of sensing parts (nozzle) of capacitance and co-axis line of FTC fasten 2. Ensure mechanical parameter is matched with actual situation, such as lead screw pitch, etc 3.Reduce the highest speed of axis and accelerated speed of axis, increase sensitivity, tracking compensation and tracking allowance 4. Re-calibrate floating head
Cutting head has over pulse before reaching position	1. Firmness of motor is not sufficient 2. The value of the	1. Adjust the firm device of motor driver 2.Adjust tracking allowance and tracking compensation

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	allowance of capacitance is too greater. 3.The value of the allowance of capacitance is too small 4. Floating head calibration is poor	3. Re-calibrate floating head

6.3 Unit Replacement

As for the methods of replacement of FTC, Preamplifier, sensing probe, signal line and power line, please refer to the third section Installation &Connection.

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7 Technical Index

Figure7-1Technological Index

Parameter Class	Name	Descriptions
Environmental Conditions	Operating temperature	FTC: -10℃～+55℃ Capacitance sensory package: -10 ℃ ～ +300℃
	Storage temperature	-20℃～+70℃（Non-condensation）
	Relative Humidity	5％RH～95％RH, Non-condensation
	Atmosphere	70kPa～106kPa
	Others	Free of conductive dust and corrosive gas, without explosion hazard
Power Input	Rated operational voltage	12/24VDC (±10%)
	Rated operational current	≤120mA (excluding motor drive)
Safety requirements	Safety requirements	Various components of FTC91 Series and PCB accord with the safety requirements of IEC60950-1/EN60950-1& GB4943.
Reliability index	MTBF	≥10,000 hours
	Annual repair rate	＜1%
	Water-proof & dust-proof	IP20 (users maintain operative surface normally)
Mechanical parameter	Size	236mm（length）×156mm（width）×37. 5mm（height）
	Weight	＜1kg
	Coaxial cable length (standard configuration)	10cm

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8. Abbreviation

English Abbreviations	English Full Name	Chinese Name
FTC	Focus Tracking Controller	焦点跟踪控制器

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